Space Weather Technical Forecast

Issued on Friday, 20 September 2024 at 01:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of R1/R2 with isolated M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity measured by GOES16 and 18 has been Low, with low level C-class flares from various regions.
There are now six sunspot regions on the disc, although AR3824 will rotate behind the west limb today. AR3824 and also AR3825 have E Zurich classifications and beta-gamma magnetic configurations. However, AR3828 in the southeast quadrant is the most significant region with a Chi/beta-gamma-delta classification, although AR3831 is close to developing a small weak delta spot and therefore is another region of interest. The remaining two sunspot groups are small and simpler.
A large upper-coronal dimming was visible in AIA211 with a slight western solar hemisphere bias near 40-50N between 19/0600-1200UTC. This may correlate with ejecta becoming visible from the north of the occulting disc on Lasco C2 , which has been analysed as not being an Earth-directed Coronal Mass Ejections (CME).

Solar Wind / Geomagnetic Activity: Solar wind parameters, as observed by ACE at L1 indicated a slightly disturbed solar wind environment, possibly either residual CME influence from the CME arrival on the 16th, or from weak coronal hole influence from CH70 and CH71, or a combination of both. The solar wind was predominantly at Slightly Elevated levels, gradually declining from between 450-500km/s to end the day around 400 km/s. The solar wind peaked at 529 km/s at 19/0836 UTC. The phi angle was mostly positive (away from the Sun), which supports the option that weak HSS influence from CH70 and CH71 have agitated the solar wind parameters. The solar wind density remained below average with single figures ppcc. The IMF was weak to moderate, ranging between 5-9nT at 19/0716 UTC. The north-south component of the IMF varied between -8 and +7nT, and the resulting geomagnetic activity started at G1/Minor Geomagnetic storm intervals (Kp 5) then declined to become Quiet to Unsettled (Kp 2-4).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 was below the S1/Minor Solar Radiation Storm level, steadily falling to Background levels.
High energy electron flux (greater than 2MeV) observed by GOES16, generally varied on a diurnal cycle between Normal Background to Moderate levels, although briefly peaked at High levels, reaching 1227 pfu at 19/1745 UTC. The associated 24-hour fluence initially had a fairly steady trend before increasing later in the day, with the 20/0001UTC observation being 2.49e7.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with a Chance of isolated M-class flares. There is a continued Slight Chance of an isolated X-class flare, most likely from either AR3825, AR3828 or AR3831, plus from any new or returning regions that emerge from the far side.

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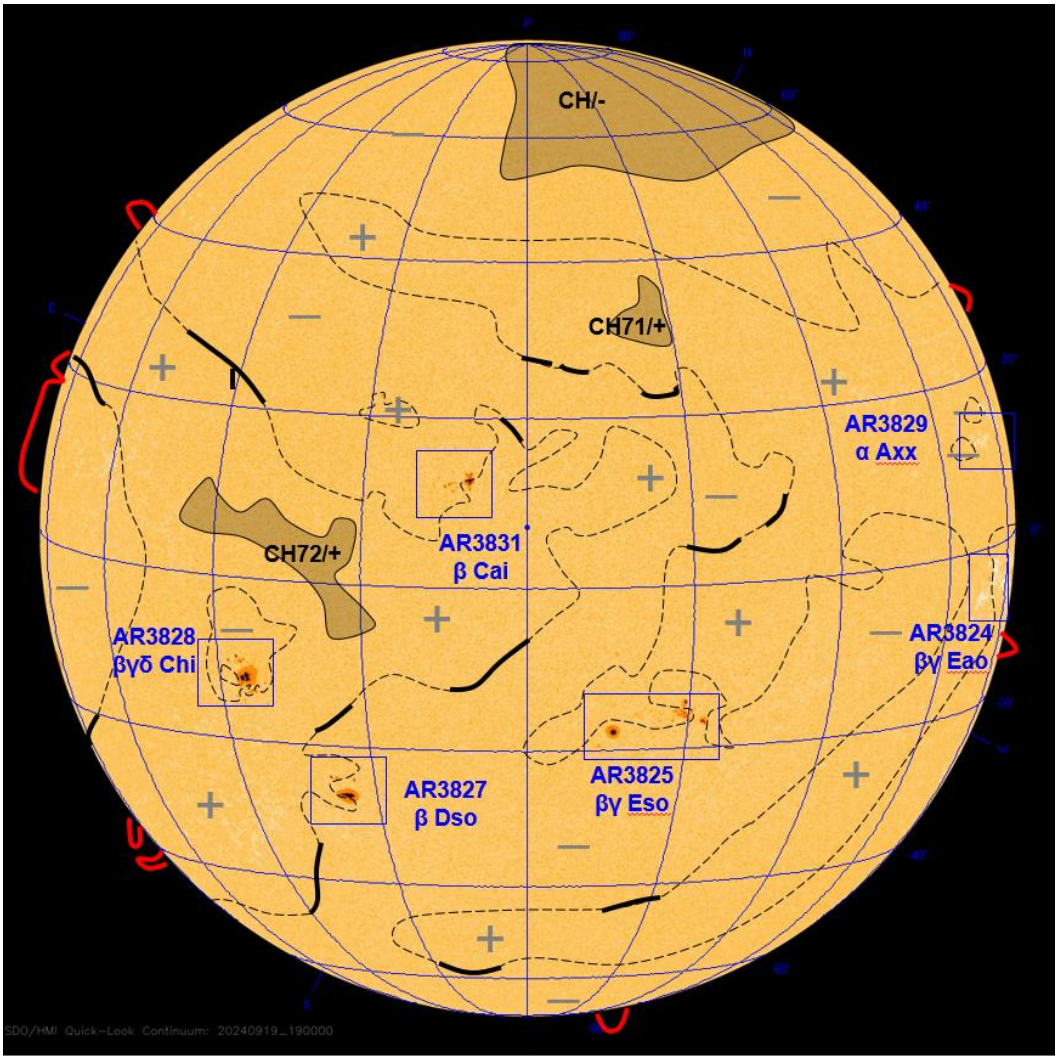
Solar Wind / Geomagnetic Activity: No CMEs feature in the forecast. The solar wind is expected to be at Background to Slightly Elevated levels, due to possible occasional weak coronal hole influence from CH71. Geomagnetic activity is expected to be mainly Quiet to Unsettled (Kp 1-3), but with a chance of isolated Active (Kp 4) intervals, these mainly days 3 and 4 (22nd and 23rd).

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 will most likely remain at Background, with the daily risk of a Slight Chance of enhancement. The most likely sources would be any significant flaring from AR3824 and then, increasingly, AR3825.
High energy electron flux is expected to see an overall rising trend, remaining at Moderate to High levels with peaks during the diurnal maximum. The forecast is uncertain, but fluence values are anticipated to slowly rise into the period.

Figure 1. Solar Analysis Valid 19/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs feature in the forecast. The solar wind is expected to be at Background to Slightly Elevated levels, with possible occasional coronal hole influence from CH71 from day 2. This coronal hole feature has diminished, becoming small, and any solar wind enhancements are likely to be weak with solar wind speeds reaching 450-500 km/s.
Geomagnetic activity is expected to be mainly Quiet to Unsettled (Kp 1-3), but with a chance of isolated Active (Kp 4) intervals these mainly days 3 and 4 (22nd and 23rd).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	5	5	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X-Ray Flares:

There are currently six sunspot regions on the disc. The disc is dominated by two Zurich E-groups in the southwest quadrant; AR3824 and AR3825. AR3824 appears to be in decline but this is uncertain due to the viewing angle as the region approaches the west limb. Therefore the previous analysis has been retained. AR3825 has a history of X-class activity, although the recent trend has been for elongation and slight decay of the westernmost penumbra. AR3827 has also shown a slight increase, with rudimentary penumbra developing on some small trailing spots, and it is now classified at Dso/beta. AR3828 remains a complex region, with some very small and weak delta spots. AR3831 is also of interest, due to continued slight increase in penumbra, which is close to resulting in a small and weak delta spot development within the lead spot group.
Activity has been Low with only C-class flares observed over the past 24 hours. There is a chance of R1-R2 events with isolated M-class flares, and a slight chance of isolated X-class flares, with AR3825, AR3828 and AR3831 the most likely sources of any significant flares.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

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Solar Radiation Storms - (High Energy Protons):

High energy proton flux at GOES18 reached the S1/Minor Radiation Storm level during 17 September but has since declined to Background levels. There is a chance of new enhancements during the forecast period following any significant flares, these most likely from AR3824 given its more favourable position in the western solar hemisphere. AR3825, in the southeast, also presents an increasing risk as a source in the event of any significant activity, having previously produced a proton response from 50 East.
Overall, high energy proton flux levels are expected to remain at Background. However, a Slight Chance of enhancement from AR3824 and then AR3825 persists through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

Following the arrival of the CME late on 16 Sep, high energy electron flux levels at GEO have increased to reach predominantly moderate levels, with a generally steady trend, despite the brief increase to High levels peaking at 19/1745 UTC. The high energy electron flux is expected to remain at Moderate to High levels for much of the forecast period, although confidence is low as any increase in geomagnetic activity associated with a weak HSS from CH71 could suppress the electron count again.
The forecast is therefore uncertain, but fluence values are anticipated to slowly rise through the period, with a chance of rising above the Active threshold. MOSWOC REFM is not considered to be offering significantly useful guidance, given that it is underestimating the current fluence values.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	40	50	60	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: GOES 16 Electron Flux (bottom) and MOSWOC REFM model (top)

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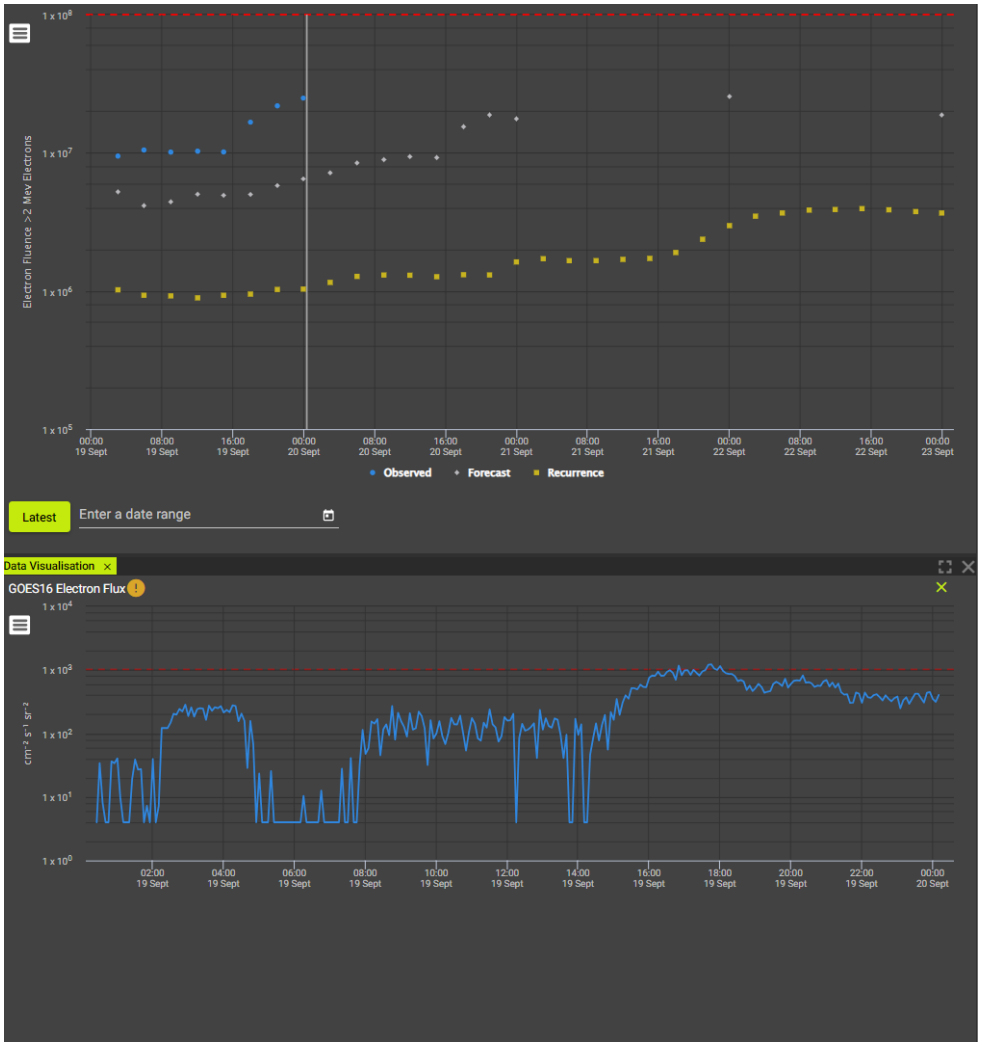

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